JOURNAL

JUNE, 1933

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LAMB
BALL BEARING
INDEX
TABLES

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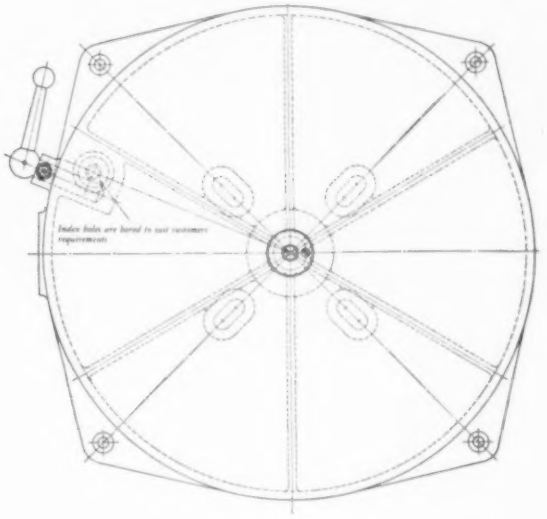

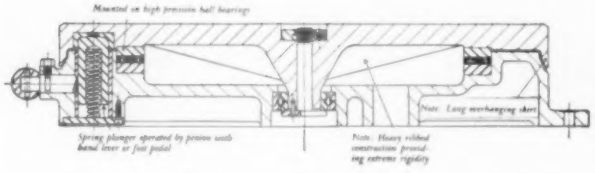

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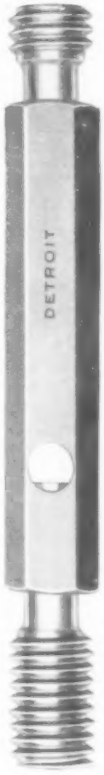

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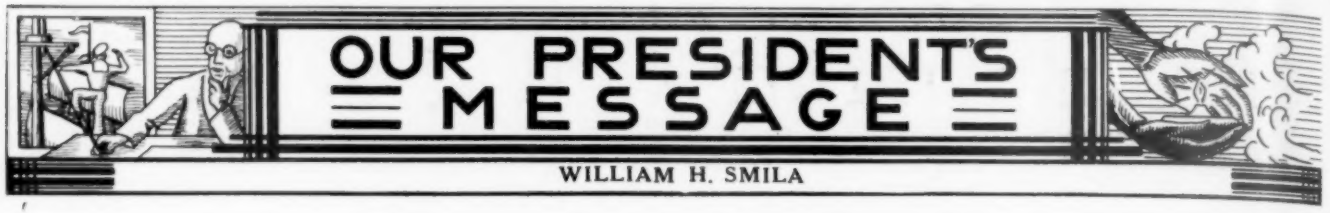


INDUSTRIAL RELATIONS

ONE of the newest and most important committees of our society is the Industrial Relations Committee. This committee, with Mr. Robert Lippard as chairman, has made wonderful progress in the short time it has been organized, and we expect some real accomplishments during the coming year.

The object of this committee is to act as an aid in securing employment for our unemployed members, whenever possible, and also to aid in supplying employers with the type of men best suited for the position to be filled. At the present time there are many more available men than there are available positions. We hope, and have every reason to believe, that this condition will soon change and that the number of "open" positions and men available will more nearly balance.

Up to the present time this committee has devoted its efforts to creating a form to be "filled in" by the applicant and to establishing itself with the Employer's Association and the Employment Managers of many of the larger plants of the city. We hope eventually to enlist the aid and co-operation of every Employment Manager in the Detroit area. This can only be done by establishing confidence in our society and its members.

The general qualifications of all members are on file in the Secretary's offices, but a more detailed account of these qualifications is necessary in selecting men to fill positions. Therefore, each applicant should carefully, conscientiously, and completely "fill in" his application blank if he wishes it given proper consideration. All other things being equal, the applicant longest unemployed, or with the greatest number of dependents, will be given preference. As soon as an applicant has been notified of "an opening" he should lose no time in personally applying for the position, as by so doing he will show that both he and the committee are "on the job." In like manner, failure to report results will not only discredit himself, but also the committee.

Owing to rapidly changing conditions and anticipated large number of applications, it will be necessary for each applicant to have his application renewed every thirty days. This can be done by notifying the secretary by mail or phone that the application should be renewed.

As soon as an applicant obtains employment (either through the society's or his own efforts) he should notify the Secretary so that his application can be cancelled, thereby strengthening the chances of the other applicants.

At our regular meeting held at the Detroit-Leland Hotel on May 11th, Mr. Lippard explained the progress of this committee in detail and asked that all members desiring positions fill out the form created for this purpose. Those members who were unable to attend this meeting and who desire to fill out one of these blanks may get an application form by writing or phoning our Secretary. At a later date it may be possible to increase the scope of this service, but at present it is confined to the Detroit area.

This committee can only attain success through the co-operation of our members. If any member is in need of men or knows of any available position he should notify Mr. Lippard or our Secretary to that effect, and the committee, in turn, will advise worthy and well qualified men to make application for the position.

THE Industrial Relations Committee has been especially active during the last thirty days. Mr. R. M. Lippard, Detroit Branch Manager of the Heald Machine Company, who is Chairman of this Committee, has appointed as assistants:

W. J. Fors (Secretary)
Earl Lowe
Louis Peterson
E. E. Anderson
Louis A. Kirchner
Walter Wagner
A. M. Sargent (Ex-officio)

There have been two major meetings of this committee, in addition to various minor discussions, which have resulted in the establishment of a definite method for an organized effort to assist our unemployed members in locating satisfactory positions. Application blanks have been drawn up and printed and are available in the Secretary's office. Letters have been written to the Personnel Managers of all major plants, and definite results are expected within a short time.

No other committee has submitted reports or indicated activity within the last thirty days.

SEEN AND HEARD AT THE MAY MEETING

VERY large attendance at this meeting. Much warmth in greetings as old friend meets old friend he has not seen in years.

Meeting called to order by President Smila. Bob Lippard, Chairman of the Industrial Relations Committee, gave a very interesting report of the work his committee is doing. They are arranging to contact employers with the intention of becoming acquainted. They want to establish in the minds of employers that this organization is composed of experienced and skilled tool engineers, and that the employers' needs in this field can best be filled by this organization. "When in need of material go to its source." All members who are now unemployed were asked to fill out an information sheet for record in the Secretary's office, to be used in recommending members for positions.

President Smila reported that the Juniors are organizing a base ball team and have challenged the Senior members to a game. Earl Ruggles kas appointed manager of Athletics, and will get together a Senior baseball team to uphold the honor of the Seniors in the field. Mr. Ruggles asks all members who can play ball to get in touch with him.

Some member asked Mr. Giern why he did not report to Ruggles. Giern replied that he knew nothing about the game. Another member then suggested that he apply for the job of umpire.

By popular vote it was decided that the June meeting would be a "Get together" meeting, if you know what that is. Details elsewhere on this page.

Also, all members prepare for a field day some time in June.

The Cleveland Twist Drill Company showed a very interesting film on the uses and abuses of twist drills, and members of the Charles A. Strelinger organization distributed hand books on the same subject.

We are sure that quite a few of those present learned something about their home town from Harry C. Heffner's talk about Detroit.

See "Bill" Fors for emblems of the Society.

Mr. Hoffman mentioned a desire for more articles on operation planning in the Journal. Members please contribute.

NEXT MEETING

DATE—Thursday, June 8th.

TIME—Eight P. M.

PLACE—Gentsch Hall, formerly K of P. hall, 6424 Gratiot, 1½ blocks east of Mt. Elliot.

PURPOSE—Get together and get acquainted.

PROGRAM—Picture and Talk on Industrial Russia, by Jay K. Wohlfield, member A.S.T.E.

FEATURE—Special musical program furnished by Paul Serduchanky and his celebrated Russian Orchestra, including specialty singing and dancing numbers.

ADDED FEATURES—Immediately following the meeting, legal refreshments and a free buffet lunch will be served. The Committee assures all will get acquainted if the members assure all will get together.

SLOGAN—Every member bring a guest.

ANNOUNCEMENT

A.S.T.E. FIRST ANNUAL FIELD DAY AND PICNIC

SATURDAY, JUNE 24th, AT 11:00 A.M.

AT BELLE ISLE

FOR MEMBERS AND FAMILIES, ALSO GUESTS.

BRING PICNIC LUNCH.

Through the courtesy of the Holbrook Market Co. with stores on Grand River at Oakman Blvd. and Livernois at Fenkel, the refreshments and lunch for the field day will be furnished without profit to them.

NEXT JUNIOR MEETING

Thursday, June 22nd. **Seniors Invited.**

Detroit College of Applied Science.

8:00 P. M.

Mr. Raymond J. Walter

Speaker: Raymond J. Walter, formerly chief of the special machine designing department for the Ford Motor Company, chief tool designer for the Hupp Motor Car Corporation and assistant chief engineer for the Detroit Insulated Wire Company.

Subject: Examples of Machine Designing.

TECHNICAL

JOHN M. CHRISTMAN RAYMOND J. WALTER W. J. McKEEN

DESIGN OF HYDRAULICALLY OPERATED, AUTOMATICALLY CONTROLLED, MULTIPLE SPINDLE HEAD, DRILLING MACHINE

RAYMOND J. WALTER

(Continued from last issue)

IF we assume that we shall use this set of gears, our plan of gear layout will be as shown in Fig. 1.

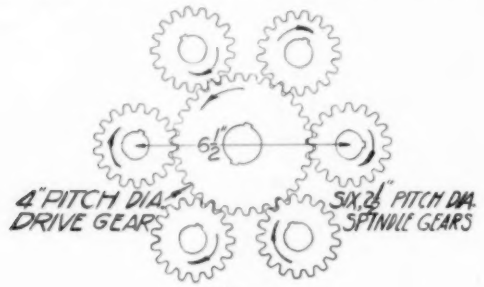


Fig. 1

Tool Engineering Bulletin No. 2 (A.S.T.E. Journal, July, 1932) specifies that the best speed for drills to turn in drilling cast steel is 40' per minute, and that the speed of the drill then will be 306 r.p.m. If our spindle gears have to turn at this rate of speed our spindle gear will turn at the rate of

$$\frac{2.5}{4} \times 306 = 191 \text{ r.p.m.}$$

As we see by our plan of gear layout for our head, the spindle gears will turn clockwise in order to drill properly, and our drive gear will then turn counter-clockwise. As we are designing our own driving unit, this will be satisfactory, as we may use a motor that is reversible. However, this is perhaps a good place to warn would-be designers of the very important fact that, if you should be required to use a specified drill press, be sure that your drive shaft gear is turning in the same direction as your drill press spindle, or that it can be reversed to run as your design demands. This will oftentimes materially change a design of a head, as can be illustrated in our own example above.

Suppose that it was necessary to have the drive gear turn clockwise. Then we could not use the gear layout as we have planned, but would have to use an idler gear between the drive gear and the spindle gears. We might have a gear layout that looks like the one shown in Fig. 2.

In Fig. 2, the drive gear is shown turning the same as the drive gear in Fig. 1. It will be seen that the drills will then be turning left handed, and that if we reverse our drive gear, or, in other words, run it clockwise, our drills will be turning in the same direction, or right handed, as they would have to run for standard drills.

There is a matter of choice on spur-gear-driven heads as to whether we shall use the standard tooth or the stub tooth gear. Personally, I have a leaning towards the stub tooth gear wherever possible, because of the greater strength of the stub tooth.

Where it is necessary to have quietness of operation, or where great strength must be obtained in a limited amount of space, helical gears are often used, and, although they are more expensive for first cost, they make a very excellent product that is fast coming into favor with the industry.

Now a word before we figure the strength of the gear teeth and the pitch required for this particular job. It is a proved fact that the theoretical strength required for any given case may be figured very accurately and yet these same gears may not stand up as they should. The strength may be adequate, but unless the proper steel is selected the strength element will be blasted because the steel used may lack the proper wearing qualities. It is an almost certain fact that if we figure the right wearing qualities for the job that has to be performed by the gear teeth we are quite sure to have the correct strength. It is not, however, just a matter of choosing the proper steel; the heat treatment also enters into the problem.

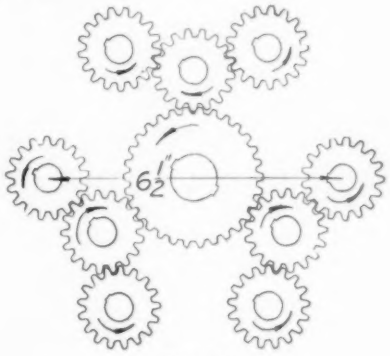


Fig. 2

We shall now determine both the strength of tooth required as well as the wearing qualities necessary for this job, which will also give us the width of face required.

(To be continued next issue)

STRENGTH OF MATERIALS

JOHN M. CHRISTMAN

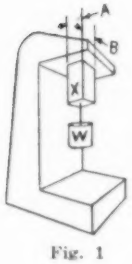


Fig. 1

THIS article is easy to understand and interesting, and by giving it careful thought it will enable one to solve many valuable strength of materials problems. By mastering this a surprising amount of fear will be removed, and even problems that will not be covered in these articles will become self explanatory. In all of the following problems the weight of the bar is neglected.

In Fig. 1, if A = 1 inch, B = 1 inch, and W = 1000 lbs., the bar X will be stressed to 1000 lbs. per sq. inch. In other words the bar has a sectional area of 1 sq. inch and is loaded by a weight of 1000 lbs.

If A = 4 inches, B = 3 inches and W = 120,000 lbs. the bar will be stressed to $\frac{120{,}000}{4 \times 3}$ or 10,000 lbs. per sq. inch.

Problem: If A = 2 inches, B = 2½ inches, and W = 26 lbs. what will be the stress per sq. in. of the bar?

Answer: 5.2 lbs. per sq. in.

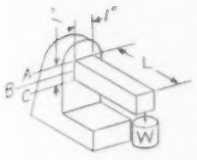


Fig. 2

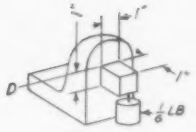


Fig. 3

In Fig. 2, when a weight is applied at W, the fibers of the bar are stretched along line A, and are compressed along line C. In other words the bar tries to rotate around the axis B. If this bar is made of steel, axis B will be midway between A and C, due to the compression strength of steel being the same as the tensile strength.

The extreme fibers along A are farthest from axis B and are stressed more than any other point when a weight is applied at W, and if enough weight is applied the steel will pull apart along line A before elsewhere.

In Fig. 3, the bar is 1 inch long, 1 inch high, 1 inch wide, and according to a table which will be explained farther on in this article the stress along line D is 1 lb. per sq. inch when a weight of 1/6 or .167 lbs. is placed at the end of the bar.

The bar in Fig. 2 has the same section as the bar in Fig 3, and by simple proportion the following problems are easily solved:

Problem: If 1/6 of a lb. cause a stress of 1 lb. per sq. in. along D in Fig. 3, how much stress will there be along line A in Fig. 3 if L = 10 inches and W = 1/6 lb.?

Answer: 1/6 × 10 or 1⅔ lbs. per sq. inch.

Problem: If L = 24 inches and W = 1/6 lbs. what will be the stress along line A?

Answer: 4 lbs. per sq. inch.

Problem: If L = 1 inch and W = 1 lb. what will be the stress along line A?

Answer: 1 ÷ 1/6 or 6 lbs. per sq. inch.

Problem: If L = 10 inches and W = 100 lbs. what will be the stress along A?

Answer: (100 ÷ 1/6) × 10 = 6000 lbs. per sq. inch.

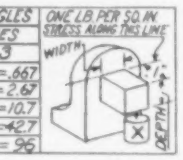
Problem: If the tensile and compression strength of steel is 90,000 per sq. in. and if L = 24 inches what weight at the end of the bar will be required to break it along line A?

Answer: $\frac{90000}{6x24}$ or 625 lbs.

Many hand books have tables showing the section moduli for various shapes or sections of bars.

A partial table for rectangles is shown below:

SECTION MODULI FOR RECTANGLES			
DEPTH IN INCHES	WIDTH IN INCHES		
	1	2	3
1	X=.167	X=.333	X=.667
2	X=.667	X=1.33	X=2.67
4	X=2.67	X=5.33	X=10.7
8	X=10.7	X=21.3	X=42.7
12	X=24	X=48	X=96



This table gives the weight x that is required to produce a stress of 1lb per sq. in. along line A when the bar is 1 inch long.

Problem: If a bar is 4 inches high and 2 inches wide and 1 inch long and fixed at one end, what weight will cause a stress of 1 lb. per sq. inch along line A?

Answer: 5.33 lbs. (taken from table.)

Problem: If a bar of steel 48 inches long, 12 inches high, and 3 inches wide is fixed at one end, what load at the other end will break this bar, using 90,000 per sq. inch for the ultimate tension and ocmpression strength?

Answer: $\frac{90000 \times 96}{48}$ = 180,000 lbs. or 90 tons.

Note: 96 was taken from table.

CHROMIUM PLATING FOR WEAR RESISTANCE

By CHAS. G. HEILMAN

CHROMIUM plating has attracted more interest, and more capital and effort have been spent in its development during the past several years, than in any other branch of the electro-plating field.

Contrary to the generally held opinion, the knowledge that chromium can be deposited on metal from a solution is not a new discovery. The earliest known deposition of chromium was accomplished by Bunsen, a world renowned German chemist, who incidentally is the same scientist who gave us the Bunsen burner. The record of his work was published as early as 1854. At intervals we find other references in scientific literature to chromium plating, but apparently no effort was made to commercialize the process. In 1905 Carveth and Curry published the results of research work done at Cornell University, in which they stated that a bright plate resembling the finest silver could be produced without stirring the solution, and that for plating purposes the metal should have a great future before it. In 1912, Sargent, also working at Cornell University, made a detailed study of the possible composition of chromium plating baths and worked out certain ratios of chromic acid and sulphate which gave him the most satisfactory plate. While other solutions have been developed and are being used, the very large majority of plating engineers prefer Sargent's solution and are using it at the present time within the proportions of chromic acid and sulphate that he found most desirable.

It remained, however, for Fink and Swartz to call attention to the commercial possibilities of chromium plating. They found Sargent's solution to be the most practicable yet developed. The results of the work of Swartz under the direction of Dr. Fink were published in 1923 in the Transactions of the American Electro-Chemical Society. This paper aroused a wide spread interest among the engineering fraternity and marked the beginning of intensive research by various scientists and corporations to develop the art and apply it practically. Scientists and engineers in the automotive field especially became interested. Among the companies in the Detroit vicinity who pioneered in this development were the General Motors Corporation, to whom we are indebted for the first practical application of chromium plating to production automotive parts, the Detroit Edison who financed a research program at the University of Michigan, and others. The Bureau of Standards, in 1925, published the results of the successful application of chromium to printing plates at the U. S. Bureau of Engraving, claiming a very marked increase in the useful life of the plates. This is the first published record of the commercial use of "hard" chromium plating. From that time to the present

*Commonwealth Industries

day, the development has been most rapid.

Chromium is deposited on metallic surfaces usually for one or both of two purposes. (1) For decorative and rust resistance purposes, as e.g., automobile radiator shells. (2) To add greater durability and wear resistance, as e.g., plug gages, and in the case of water pump shafts to resist both wear and corrosion.

For decorative and rust resisting purposes, the chromium layer is practically always superimposed on a layer of nickel, or copper and nickel. For this purpose the chromium layer is usually about five one-hundred-thousandths of an inch (0.00005") in thickness. This extremely thin layer of chromium very markedly increases the resistance of the under coatings to discoloration and to corrosion of the base metal, and enhances the appearance of the part plated. The development of the use of chromium for this purpose has been most rapid since 1925, until at the present time practically all plated parts, where the price warrants, are now given this finish. Any further developments are more likely to be in the improvement of the technique of the plating process than it its more widespread application.

In the field of chromium plating to resist wear, the development has also been very rapid. But while it is being used for a great many purposes in a large number of industries, and while new fields, where its remarkable resistance to wear can be utilized, are continually being discovered, I am convinced that the next few years will see chromium plating much more extensively used for this purpose. "Hard" chrome plating, as plating for this purpose is usually known, is practically always plated directly on the base metal and not on an under coating of copper and nickel.

Chromium owes its remarkable durability to a peculiar combination of extreme hardness with a very low coefficient of friction. Various authorities have attempted to measure the hardness of chromium. According to Moh's scale (used in measuring the hardness of minerals) it has a hardness of 9. It can be scratched by only the diamond and corundum. In Moh's scale the hardness of the diamond is the standard and is given a value of 10. The coefficient of friction of chromium on steel or babbitt is reported as considerably below that of any other commonly used metal or alloy.

Hard chromium plating is at the present time being used for such a wide variety of uses that it is futile to attempt to make a list and flatter oneself that it is complete. I will try to mention a few of the more common uses and then elaborate on some of the precautions that should be taken by both the plating plant and the customer to secure the maximum benefit from it.

As mentioned above, the first reference in technical literature to hard chromium plating was that of the U. S. Bureau of Standards to its use on printing plates for the Bureau of Printing and Engraving. At the present time, the bureau is chroming the plates used in the printing of paper currency and postage stamps. The U. S. mint is chroming coin stamping dies. It has been reported that a thin layer of chromium is being applied to the bore of small and large caliber guns, which has the affect of reducing the erosion and wear as well as increasing the resistance to corrosion and thus increasing the life. The reported thickness of chromium used is four ten-thousandths (0.0004") of an inch.

In the automotive field, a great variety of parts are being chromed. Where the cost of plating and regrinding is less than the cost of new parts, a saving can be made by salvaging parts that have accidentally been overground. Automobile parts such as wrist pins, ball races, steering knuckles, rocker arm shafts, valves, cam shafts, crankshafts, pump parts, cylinder walls, are some of the parts that have been plated. Wrist pins are being plated as a regular operation in some instances. After the finish grind, a thin plate of chromium is added. The wrist pins are carried through the plating bath on a mechanical conveyor, insuring each piece being subjected to the action of the current for the same time and consequently very closely controlling the amount of deposit. In the aeroplane field, where government inspection insures the maintenance of all parts in practically perfect condition and where overhauling of motors is required after a limited time in the air, a considerable saving is being made by building up worn parts with chromium. Such parts are crankshafts, rocker arm shafts, bearings, and so on.

In the field of gages, chromium has been more widely used than for any other purpose. In the beginning it was largely used as a means of salvaging gages that had been worn beyond their useful size. Today nearly all gages are chromium plated when the gages are made. The increased useful life of a chromium plated gauge seems to vary from 100% to 5000% over that of a hardened tool steel gauge. These gages when worn, can be plated over and over again. The difference in cost per piece tested between the use of chrome plated gauges and gages of any other material is so great that its advantages were easily demonstrated, and this accounts for the very rapid rise in popularity of this type of tool. It has also aided the plating engineer to sell more easily the use of chromium for other purposes.

One of the most useful and profitable fields for the use of "hard" chrome has proved to be that of a "putting on" tool in the salvaging of overground parts. Millions of dollars worth of jig, tool, and die parts have been saved in the automotive industry alone in the past five years. Often pieces worth several hundred dollars can be salvaged at a cost of only three or four dollars.

In the field of cutting tools, chromium is being used for cutting non-ferrous materials that are soft but abrasive, as alumium, copper, nickel, brass, bronze, fibre, bakelite, and almost all non-metallic materials. Even on iron and steel cutting tools, it has its usefulness in reducing the wear due to chips flowing from the cutting edge. In slitting saws a thin layer of chromium will reduce the abrasive wear on the side of the teeth. Burnishing broaches show an average increase of 500% in life over high speed steel, and, of course, after wearing the chromium can be removed, and the broach replated and ground at a moderate cost. Thread chasing dies are being plated at a considerable saving in cost per piece.

Rolls used in the production of stainless steel parts are being chrome plated. In some cases, it has been a life saver, as no other material would last long enough to make the operation feasible.

A greatly increased life is being obtained on stamping and drawing dies, drop forge dies, die casting molds, and molds for plastic materials by the use of chrome plated surfaces.

In the Pneumatic Tool industry, the art is being used to reclaim pistons, cylinders, valves, and other parts subjected to wear and corrosion. When a tool is returned for overhauling, the worn parts are replaced by parts which have been plated and ground to standard size, and the worn parts returned to the factory for reclamation. Thus the tool is repaired at a lower cost than formerly, it is laid up for repairs a very short time, and returned to the user in a condition that will give several times the service that the original tool did. In the metal tube industry, mandrels and dies used in drawing tubes are being plated with advantageous results from the standpoint of economy and quality of finished product.

Among the other uses of "hard" chromium plate are electrotypes and various kinds of printing plates and printing rolls; metal rolls and paper calendar rolls in paper mills; guide strips for lathe and planer guides; feed screws for lathe tool carriages; screw machine cams and screw machine spindles; all wear parts on internal and centerless grinders to resist erosion of the abrasive dust; parts that must resist heat, corrosion, and the erosion of water as in the rubber, textile, glass, paper, plastic, power, and food industries; on shaft bearings, where it is possible to get and maintain better alignment on account of reduced wear.

The technique of "hard" chromium plating, like that of any other branch of engineering, is constantly being improved. The operator has his own peculiar problems to solve, which offer him sufficient opportunity to exercise his ingenuity and maintain his interest in his job. The pitfalls that beset him are of quite a different nature than those that bother the decorative plater, and consequently it is inadvisable to try to turn out both types of plating in the same plant. The "hard" chrome plater must maintain a closer control of his solutions. The proper temperatures for a successful plate are different from those of the decorative plater; it is more essential to keep the cleaning solution in perfect condition; the time of plating is a great deal longer; and since the throwing power of his solution is less, the use of conforming anodes is frequently necessary.

In designing a part where it is desired to use "hard" chromium it is just as necessary to select the proper material and heat treatment for the base metal as if an ordinary de-

sign were being contemplated. Where abrasive wear is the only factor, a soft material can possibly be used. The writer has known of soft screw stock plug gauges that were chromium plated and gave a satisfactory life. If considerable pressure is to be exerted against the plate, the base metal must have a sufficiently high elastic limit and hardness to resist deformation, or the chromium, which of itself is quite brittle, will move with the base metal and tend to crack. One actual example will illustrate this. Thirty-six die parts were plated in the same bath for an equal time. Thirty-four pieces of this lot gave a satisfactory life and two parts failed in a few hours. These two parts were replated, special care being exercised to avoid failure. Again they failed in a short time. An investigation indicated that the service was no more severe than on the parts that had stood up. A hardness test showd the material to be dead soft, while the other parts were 58 to 60 Rockwell hard. The pieces were hardened and replated and worked satisfactorily.

A question that a plater is called on to answer frequently is, "What is the best thickness of chromium to use?" The only safe answer is, "That depends." In the case of precision parts that must be held very close to operate properly, a plate two to four ten-thousandths of an inch (0.0002" to 0.0004") thick has frequently proved satisfactory and is being used. A plate as thin at this has the advantage that it can be held sufficiently even over a uniform section to finish by lapping alone. A plate one ten-thousandths inch (0.0001") thick on the side of slitting saws has materially lengthened the life of the saws. A plate one-thousandth inch (0.001") thick will resist the file and give a satisfactory life for the average job. If the part can be allowed to wear more than this before it must be replaced, it may be economical to use a heavier plate. It must be remembered in this connection, however, that chromium like most other extremely hard materials is inherently brittle. Consequently, where localized pressures of high and rapidly varying intensity are likely to be met with, or where shock may be encountered, the heavier plate might fail by cracking before a thinner plate. In cases where the part is subjected to rapid or great changes in temperature, the difference in the coefficients of expension between the chromium and the base metal may cause a failure of a heavier plate before that of a light plate.

A—Chrome plated drill flutes to resist chip erosion.

Regarding the preparation of the piece before plating, a good commercial grinding job on the article usually suffices to insure a satisfactory surface on the finished part after plating. Any irregularities on the surface will be exaggerated to some extent by the plate, and the thicker the plate the greater the exaggeration. Electricity has the property of being attracted to a sharp edge or corner or point. (Hence the use of lightning rods). Since the greater rapidity of deposit depends on greater concentration of current, it is apparent why the irregularities will be exaggerated. To this quality of electricity also can be attributed the tendency to build up heavier on the end of the piece. Where this factor of building up on the edges is a disadvantage, it can be minimized to some extent by rounding the corners.

Regarding grinding, chromium can be ground with the same wheels used for hardened tool steel, but a lighter cut should be taken and the time required is twice as long. It is also necessary to dress the wheel more frequently.

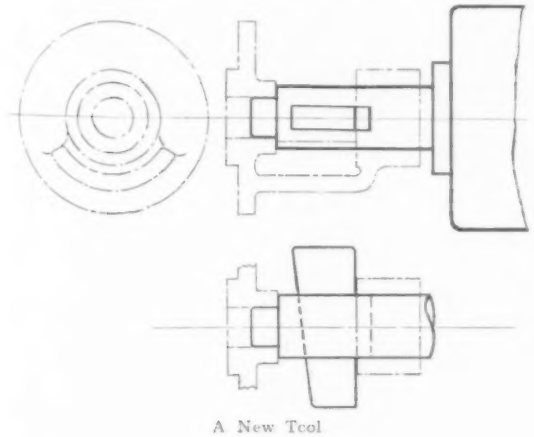
Perhaps a few words should be said about cracking of parts during the chrome plating process. In the course of the chrome plating process hydrogen is set free at the cathode, which is always the piece being plated. This gas is absorbed to some extent by the chromium plate and to a greater extent by hardened steels. This absorption or occlusion of large amounts of gas produces a strain on the metal, which strain, if sufficiently great, will rupture the part. If the piece was not sufficiently drawn following the hardening operation there would be tremendous strains present before the plating operation, and the additional strains due to hydrogen absorption are added to those already in the piece. The danger is greater in small sections or in a piece where a small section is adjacent to a much larger section and where the maker has failed to provide fillets, where sharp corners exist. The best way to avoid this danger is to use fillets wherever possible and in some cases draw the piece to a Rockwell hardness three or four points below standard. A heat treatment following the plating operation is an added precaution. This heat treatment, in a great many cases, seems to increase the useful life of the plate. The writer does not have sufficient data to state that increased usefulness follows the heat treating of the plate in every instance. Some work has been done along this line by the U. S. Bureau of Standards and by General Motors Corporation. R. J. Wirshing of General Motors Research Laboratory has stated that this heat treatment after decorative plating increases its resistance to corrosion as much as seven times.

In conclusion, I believe the possibilities of the use of "hard" chromium for engineering and industrial purposes are still an almost virgin field. There will be a great many more uses developed in the next few years. It has naturally been impossible to do much more than generalize in a paper of this length. I would like to leave one thought with you. When you are faced with a possible application of "hard" chromium, consult a firm of engineers who are specializing along this line. A cooperative study of your problem before design will usually result in the selection of proper materials that will result in maximum economy. And remember that after the decisions as to proper materials and the condition under which chromium can be used to advantage, skilled procedure and technical control in plating are still necessary to insure the maximum results.

A NEW TOOL

B. L. DIAMOND

THE accompanying sketch is of a new tool. You may say "There is nothing new in that." But it was made in May, 1933. Therefore it must be a new tool. And believe it or not, this tool was actually used on a job in a plant otherwise of good repute.



A New Tool

The tool is an arbor for facing a flange and turning the rabbet diameter true with the shaft bore. The part is an accessory drive shaft bracket of the conventional type with the two bosses connected by a rib occupying 120° of one side only. The other side is left open.

The part is held by the wedge against one boss, thereby forcing the opposite boss against a shoulder on the arbor.

The interesting part of this tool is the entire lack of consideration given to the stresses set up in the part while it is being machined. Those of you who attended the April meeting will recall the emphasis with which Mr. L. A. Danse of the Cadillac Motor Car Co. recommended that all stresses possible be eliminated in fixtures. As an example he mentioned that in the Cadillac plant on one operation it had been found necessary to hold a part with rubber faced clamps operated by hydraulic cylinders, so that the pressure on the part would be evenly distributed. This was an unusual case where extremes were necessary.

We believe that the arbor as sketched is the other extreme, and that difficulty will be had in holding the alignment of the part.

What do you think of this fixture? Your criticism is invited.

APPLICATION OF NITRALLOY TO BORING BARS

By WILLIAM PETERSON*

With the development of tools for production purposes, it has been necessary to constantly meet increasingly high standards of specifications. As tolerances have decreased, it has required boring bars of harder case, greater torsional strength and greater accuracy, to withstand the usage to which they were put.

Up to the present time, there have been two types of bars which have proven unusually successful for this type of work. The first of course, is the inserted strip piloted bar which offers long life to the tool and the opportunity to build up the physical properties required for the protection. This tool however, has been limited in its application by the necessary high price and also the fact that in some instances, it was not a practical type of bar to use. The second type of bar which has proven successful, has been the carburized and hardened tool. It is so well known that it not necessary to outline the full procedure in obtaining the carburized and hardened case, but it might be well to briefly point out some of its features to explain the difficulties which have been presented. The most successful type of steel for this kind of bar is the low carbon steel of either high manganese chrome or chrome nickel alloys. Through proper heat treatment and hardening, we are able to secure a case of approximately 1/16″ depth with a hardness of approximately 85 to 90 scleroscope or 62 to 64 Rockwell reading. We are not, however, able to build up physical properties into this tool in excess of those which might normally be expected from a steel of low carbon or low alloy content.

Some of the difficulties which have been encountered with this type of tool limit the flexibility of its application and also the results which it is possible to obtain. In the first place, there is a question of distortion which arises from the high temperature at which the hardening is secured and the quenching which is required immediately after. This leads to a twist in the bar, particularly those of key way design and also to kinking or misalignment. Upon long bars of crankcase type or boring mill design, this presents a very serious straightening problem and quite often it is not possible to take all the strains out of the bar when doing this, so that in some instances at least, permanent alignment is problematical. The straightening operation upon long bars requires a long time and consequently is costly. There is also the danger of breakage and if the case is too hard sharp corners might mean cracking of the case. With this type of tool it is also necessary to maintain soft sections around location points such as block type reamer slots and single point tool sections so that distortion can be corrected after hardening and to avoid brittleness in weak sections which will lead to breakage. In addition to these difficulties which must always be taken into consideration, we have occasionally, lack of uniformity of the case due to steam pockets forming in the quenching operation or incorrect packing during carburization.

The nature of Nitralloy and the method involved is radically different from that which has been outlined above. It is hardened at a low temperature by the introduction of ammonia gas so that the steel absorbs nitrogen into the surface, thereby hardening it. This has never been successful until the introduction of Nitralloy which carries aluminum deposits. Several grades of this steel are made embodying different alloys so that physical properties can be built up into the steel depending upon the particular analysis which is used. Where high physical properties are required, this can be secured without consequent brittleness of the bar. The method of treatment is as follows: (1) anneal, (2) rough machine, (3) heat treat for physical properties required, (4) finish machine, at which point the tool is finish ground to a very close size, (5) Nitride, and (6) finish grind or lap to size.

All of these operations are self-explanatory with exception of the Nitriding. As mentioned before, this is done at a low temperature of from 900 to 950 degrees and for a varying period of from 36 to 90 hours, depending upon the case required. It has been our experience that a 72 hour period is most adaptable for our work and that the temperature mentioned gives the best case. It should be noted at this point that the length of time can be lowered and the same penetration obtained providing the temperature is increased, but in so doing, quality of the case and the hardness secured is sacrificed. The heat mentioned gives the hardest, most refined case of close grain. Inasmuch as the bar has been heat treated for physical properties after rough machining at a much higher temperature than the nitriding operation requires, there is very little, if any, distortion as no strains have been set up.

The results secured are unusually interesting. Due to the heat treatment, we can build up the physical properties which are required and to make a comparison, can secure properties equivalent to those found in heat treated SAE 3145 steel which it is impossible to secure in carburized and hardened bars. The case will have an approximate depth of .025″ with a hardness far in excess of anything which can be obtained from carburized and hardened bars, approaching 1000 Brinell or a comparative scleroscopic reading of 150. It is absolutely impossible to touch this case with a file, regardless of the pressure exerted. At the same time there is very little, if any, distortion and what there is, is readily straightened. For example, upon keywayed bars of the arbor type of 50″ to 60″ length, we would secure in a carburized and hardened bar, a twist of approximately one-third its circumference and an arc of distortion of approximately 3″ to 3½″. The same bar made of Nitrallow in our experience, has shown a maximum arc of .090″ and no twist.

From this it can be seen that Nitralloy bars offer many advantages. Because of the lack of distortion we are able to maintain better alignment and it can be expected that this will be maintained in production. The combination of an extremely hard case to withstand rotational speeds with high physical properties in the core of the bar is an ideal one for boring bars as it answered both problems which must be met. Because of the lack of distortion and also the depth of the case (approximately .025″) bars can also be built without leaving soft sections around points of location and tool positions. The high physical properties of the steel and the thinness of the hardened case eliminates the question of breakage, whereas the lack of distortion allows the locating positions to be put in before the bar is hardened. Also, because of the extreme hardness of the case, greater life by far may be expected.

Up to the present time the experience with Nitralloy tools has been extremely satisfactory. The method is new and consequently is limited by lack of facilities for quick delivery. The tools which we have put in operation in all cases have been satisfactory and it is expected that in the future, this type of bar will be used to far greater extent.

*Kelly Reamer Co.

HOW TO TORCH-BRAZE CARBOLOY CEMENTED CARBIDE TOOLS

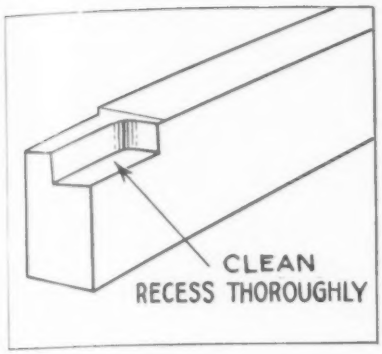


Fig. 1—Use emery paper to thoroughly clean any rust spots in recess of shank. After this all brazing surfaces should be washed with carbon-tetrachloride.

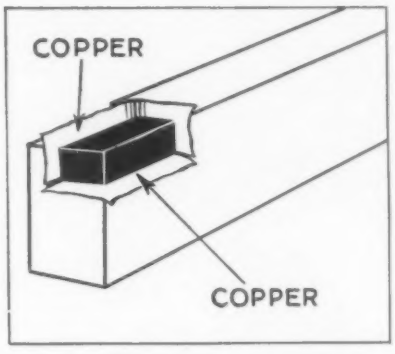


Fig. 2—Cut copper strips to fit around and under Carboloy tip, allowing surplus to overhang as shown above. Be liberal with amount of copper applied.

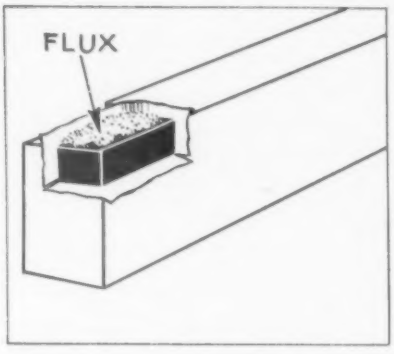


Fig. 3—Flux should be applied to shank recess and copper, and then a liberal amount of flux poured on top of tip, covering the entire surface of Carboloy cemented carbide tip.

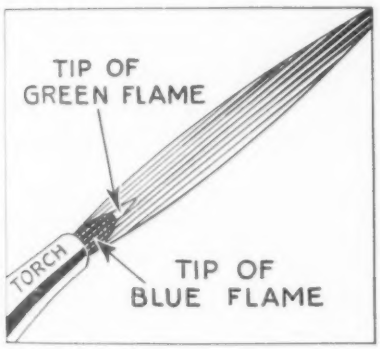


Fig. 4—Correct flame to use is shown above. First adjust torch to get blue flame, then adjust until green flame tip protrudes out of blue flame.

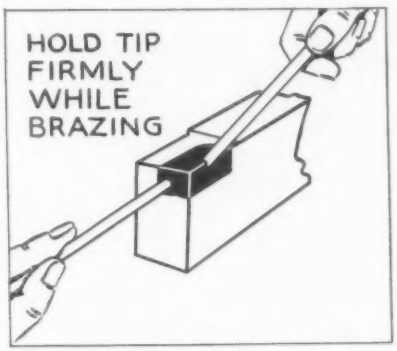


Fig. 5—Steel rods should be held in positions shown throughout brazing period. This keeps tip firmly against side, back and bottom of recess.

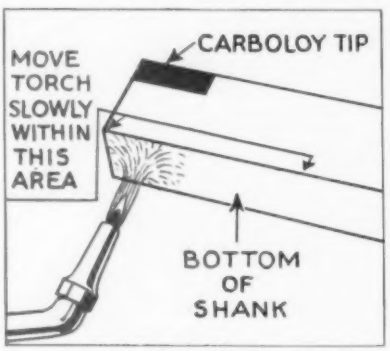


Fig. 6—Apply torch first to bottom of shank, moving slowly within area shown above. DO NOT HOLD TORCH ON ONE SPOT; ALWAYS KEEP MOVING.

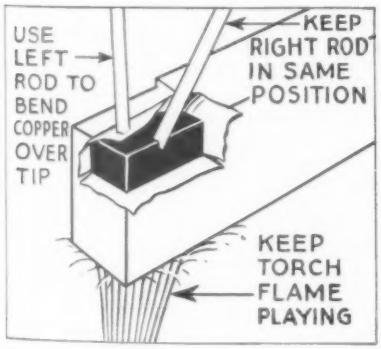


Fig. 7—When shank becomes a cherry red, use left-hand rod to bend surplus copper over onto top and sides of tip. Keep right rod pressing down, in, and towards back of recess.

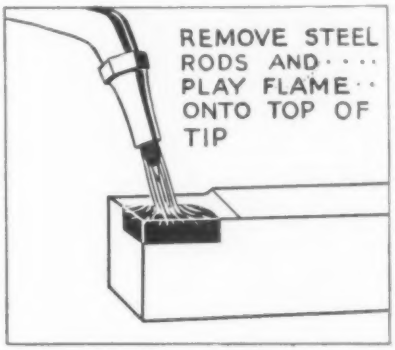


Fig. 8—When shank becomes bright red, remove rods and throw flame directly onto top of tip.

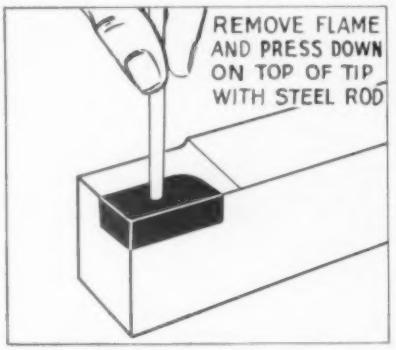


Fig. 9—When copper is melted, remove torch and immediately press down with steel rod onto top of tip. Be sure rod is placed on center of tip. Hold until tip cools slightly, then release and braze is completed.

We believe the above series of cuts to be self-explanatory. However, if interest warrants, we shall be glad to publish detailed descriptions of the operations shown above in the next issue of the Journal. Anyone desiring further information on the subject immediately is asked to get in touch with Mr. M. E. Knoll of Carboloy Company, Inc.

INTERCHANGEABLE JIG BUSHINGS

By EARL A. HUTTON

WHAT are the requisites of an interchangeable jig bushing?

The paramount function of a Jig Bushing is to provide a bearing surface for properly supporting rotating or non-rotating tools of various natures. The interchangeable feature is made necessary by the fact that jig bushings in usage require instant renewal. The complete function of an interchangeable jig bushing is to provide a replaceable wearing surface of such precision nature as to maintain accurate location of the tool it is supporting for the longest period of time. This of course, as we all know, is, of necessity, the prime reason for the conception of interchangeable jig bushings.

How can we determine the true worth of any article without approaching the same in a keen analytical frame of mind?

Have not most of us in the past accepted the old standards as completely fulfilling the functions they were originally conceived for: Should we not determine whether the old standards fulfill their functions in the entirety which we should expect? Is not the common jig bushing an article which many of us have allowed to ourselves to become too prone to accept, or place in that class whereby its usage has been heretofore considered in the main as of too small consideration? Do we consider the hundreds of thousands of these articles that are in every day use? Do we consider the bearing upon manufacturing costs, that the many thousands of any article have, in the production of, not only the necessities of life, but the luxuries, which we tool engineers are specifying?

Until the tool engineer has applied all usable knowledge, every known material, each available device, can he feel that he has fulfilled his function as an engineer in its entirety?

The common jig bushing, which heretofore we all have known in the various types that are available commercially, is the accepted means for performing the function it was originally intended for—a guiding surface for the tool it was specified to support. It is intended in their usage and application that the wearing surface provided be not only parallel with the axis of the tool they support, but the relationship of that axis of the tool they support must be maintained in relation to various other points which may determine cutting surfaces for cutting tools or locating points upon which the part is maintained.

What detrimental effect would arise from a bearing surface which is out of square with the cutting tool it supports, or out of alignment, as far as center distances are concerned, in its relation to some other bushing or locating points? This condition of course results in premature or excessive wear, not only in the bearing surface of the jig bushing, but also on the twist drill or other cutting tool which it is supporting. Therefore, a jig bushing which embodies all requisites of a commodity of that type must be supported in such manner that the bearing surface is not thrown out of alignment nor out of square in relation to the liner bushing which is holding same.

We are all very well acquainted with that immutable law that for every force there is an equal resisting force, and, consequently, we must take into consideration the fact that material having no brains will function as we fashion it. It cannot do otherwise. Therefore, we at **CENTERLOCK**, taking due recognition of the different mechanical forces which are consistently at work have been able to arrive at only one conclusion relative to drill jig bushings: it is absolutely necessary and essential in every respect, in order to properly seat a jig bushing against rotative or endwise movement, to apply that construction which results in forces which are located entirely around the circle which prevails when comparing the outer bearing surface of a renewable jig bushing, and this result of course has been obtained in our construction in a manner which precludes all possibility of misalignment or out of squareness. When dependent upon any one point or short line contact angularly in relation to axis, all rotative movement which we may properly permit *can result in only the one possible effect as far as mechanical movement is concerned, and that is an off-center condition* as permitted by the fit allowance between the renewable jig bushing and the master liner. If we graphically attempt to portray this condition using points to represent the above requisites, we obtain only the following result, which is not more nor less than a simple design which we may properly term, simple leverage. Now, on the other hand, if instead of employing what may be termed simple leverage, if we applied forces at points located 360° around the circle, i.e., employed a bearing for the purpose of restraining rotative and endwise movement, entirely around the circle, it can result in only one condition which may, properly speaking, be termed self-centering.

For that high precision requirement of renewable bearing surface which is sometimes necessary, we have resorted to the non-locking tapered seat formed on the outside diameter or bearing of our renewable bushing, employing of course a locking helix angle to restrain same against upward movement. Of course this construction is not intended for that usage whereby the renewable bushing is constantly removed and replaced, as then we have the factor of dirt or other foreign substances, to contend with. Dirt, if allowed to accumulate in any amount, is bound to destroy the accuracy which is obtained in the first instance by precision forming of the tapered seat between the renewable bushing and the master liner into which it is to be permanently located.

The paramount thought the above discussion is intended to convey may be boiled down to the statement appearing at the beginning: is not the common jig bushing an article which many of us have allowed ourselves to become too prone to take for granted, whereby its usage has been given too small consideration?

GUY M. HARTSOCK

MUFFLER BRACKET DIES

ONE of the common causes of rattles and squeaks in autochasses is poorly made exhaust muffler and til pipe hangers: the loop which clamps around the pipe or muffler end being out of round or irregular in shape so that when tightened it has only two or three points in contact. As the thickness of the stock from which muffler parts are made is never more than .050", they quickly become indented at these contact points, and as a result become loose and rattle.

Fig. 1

Fig. 1 illustrates a muffler clamp of the type in general use. It is made from rolled edge strip stock ⅛" thick by 1½" wide.

The common procedure in the manufacture of this type of clamp is as follows:

(1) Pierce all holes and cut off in a progressive die, piercing a ⅜" hole at the lower center of the loop for locating purposes.

(2) First form, breaking the attaching pads to shape and forming the upper quarter circles of the loop as illustrated in Fig. 2.

(3) Finish form the loop. This operation, for economical reasons, is generally performed in a simple die consisting of a floating mandrel representing the inside diameter of the loop, working in a half round block representing the unfinished half of the loop.

With this type of die there are always imperfections at the junction points of the radii formed at operations two and three. Another objection to a die of this type is the difficulty in removing the part from the mandrel.

A much more satisfactory die for this operation is shown in Fig. 3. The working elements of this die are A, mandrel; B, locating plunger; C, upper forming slides; D, cams for operating upper forming slides; E, lower die block; and F, G, H, J, and K, ejector mechanism.

With the die in its open position and elements A, B, and C in the positions as shown by the dotted lines, the part from the second operation is laid in the die over locating pin B and into slots in the top of slides C. In operation mandrel A travels down, clamping the part between locating plunger B and the bottom of the mandrel. Continuing on down, it loosely wraps the part around the mandrel over corners I of slide C, when the slide is in its open position.

When the part has been loosely wrapped around mandrel A and has passed down past points I sufficiently for the slides to clear, cams D start to operate on slides C, pushing them in so that at the completion of the downward stroke the part is completely confined. By adjusting the press to apply heavy pressure to all the working elements, the part is squeezed to a very accurate shape which it retains after being removed from the mandrel.

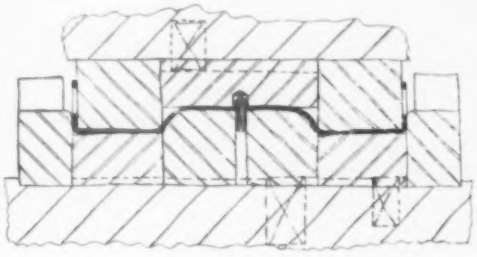


Fig. 2

The ejector mechanism consists of elements F, ejector plungers (lying closely alongside of mandrel A and riding in clots in mandrel support M); G, ejector slide (supported by square gibs attached to the upper die shoe and carrying cam projection L as shown); H and J slide operating member and support; and K, ejector slide return spring.

On the downward stroke of the press slide, operating member H slides over the lower surface and passes to the left of slide cam L as shown by dotted lines in Fig. 3, and is returned to its upright position by a spring plunger. On the up-stroke and after the upper portion of the die has raised sufficiently to release cam slides C and free the part from plunger B, cam L on slide G comes in contact with the cam on slide operating member H. As H cannot move beyond its perpendicular position, cam L causes slide G to move forward in its ways and move ejectors F forward to the dotted position, thereby pushing the part completely off mandrel A.

At the upper end of the stroke cam L passes completely over the slide operating member thus allowing slide and ejectors to be returned to their original positions by spring K, ready for the next cycle of operations.

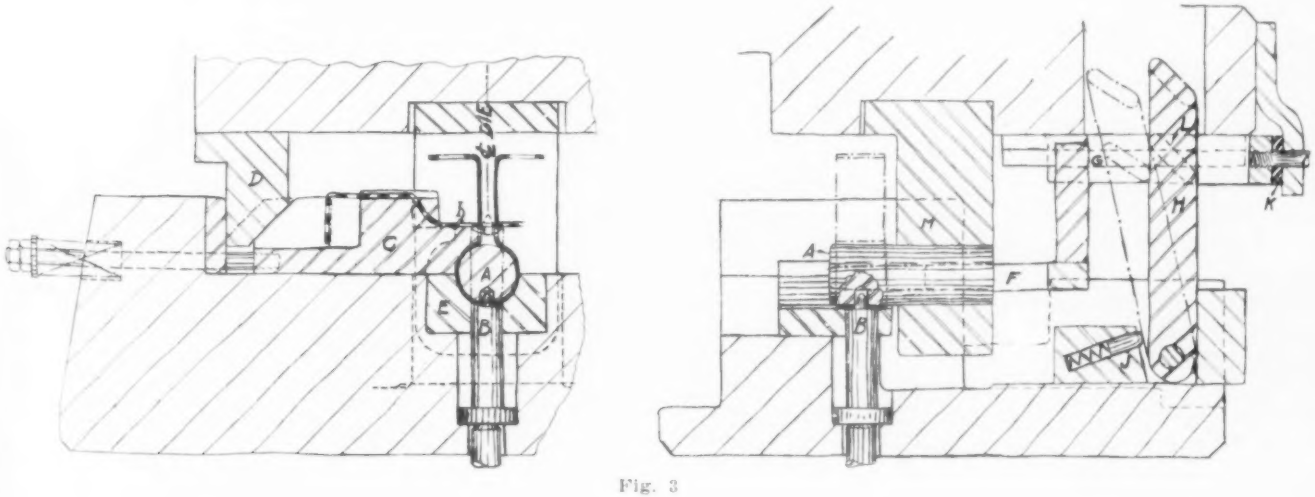


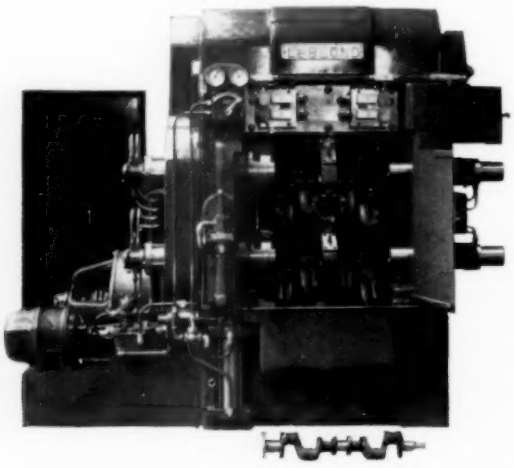
Fig. 3

NEW MACHINES

HAROLD GILLER B. L. DIAMOND

LeBLOND DUAL SPINDLE CRANKSHAFT LATHE

A NEW development in the crankshaft equipment line-up produced by The R. K. LeBlond Machine Tool Co., of Cincinnati, Ohio, is a two-spindle crankshaft lathe with further refinements in design upon the single spindle machine heretofore produced. This new machine can be



used either for facing webs of all pins on two crankshafts simultaneously, or turning the pin bearings on two crankshafts simultaneously. The machine may be arranged for either single end or double end drive according to requirements of torque developed by the turning operation. In the machine illustrated single end drive is employed, cranks being driven from the web adjacent to the flange end by oil operated pot-type chucks. The stub end spindles are moved into position on the stub end bearings and to the returned position by means of hydraulic control, to provide for loading and unloading cranks. Caps are of extra heavy design and securely held in position by a toggle clamp which is hydraulically operated and controlled by the same valves that actuate the stub end support spindles.

The oil cylinder in the front of machine actuates a rack which rotates an intermediate pinion on drive side of lathe, which is connected on a cross shaft to an identical pinion on the tailstock side of lathe. The two intermediate feed pinions mesh with racks fastened to the feed cams. These cams contact rollers mounted on the cradle, thereby rocking the cradle in and out for feed and return motions. The hydraulic system used on this machine is operated by two hydraulically balanced vane type pumps, one pump actuating the chuck and the second actuating the feeding mechanism. The oil circuit is so arranged that the combined volume of both pumps is used for rapid traverse. Feed may be any desired value at any part of the cut determined beforehand so that cams may be made to obtain the exact desired result. Motor is controlled through a dynamic switch reverse by which it is possible to automatically stop the spindle at any pre-determined position. Control circuit is interlocked with the chucking valves so that it is impossible to start the machine if both cranks are not properly chucked.

These machines are handled exclusively by Peninsular Machinery Company of Detroit, Michigan.

FLAME MACHINING

By L. G. BRADLEY*

RECENT years have found an enlarged field for coal gas cutting of small parts such as cams, die sections, and fixtures. Machine parts which in the past were made of cast iron, forgings or steel castings at high cost are now being cut with a flame.

Machine tool builders are now advertising their products as being "all steel." Tool engineers in some of the larger plants have been adble to point to substantial savings as the results of installing flame cutting machines with which the essential parts of jigs and fixtures can be built. Greater rigidity, less weight and lower costs are the result.

A variety of machines have been offered during the last twenty-five years for shape cutting and developments have continued with remarkable results. The consensus of opinion is that cutting with city gas or coal gas gives a more satisfactory edge and is of considerable importance when applied to cutting dies and parts requiring sharp edges, otherwise such cutting would necessitate the grinding of the surface to efface round edges. Although regular steels do not suffer from gas cutting, even high grades of tool steel are not effected if preheating of the entire surface is resorted to before preheating the edge, and further insures continued cutting.

*Bradley Machinery Co.

The field for gas cutting of steel parts has been very much enlarged by the application of coal gas. Due to the low heat generated the temperature gradient avoids the migration of the carbon to the surface, hence the average high grade steel can be machined about the surface, hardness being not more than .002".

In the past, machinery has been built of cast iron because it was the cheapest meathod known, but the advent of the flame cutting machine plus the butt welder are making inroads on the uses of cast iron. Some of the largest plants in Detroit whose tool engineers, always on the alert for the latest methads of cutting production costs have installed these machines amongst them, being the Chrysler Corporation, Timken-Detroit Axle Company, and Ford Motor Company.

Strange though it may seem, America, that leads the world in machine tool construction and general mechanical devices, has been lamentably behind in taking advantage of the use of city gas and oxygen for cutting steel. Thousands of these machines are in use all over the world. Yet it is only during the past two years that we in America have realized the revolutionary savings that can be made by this new process.

A return to increased production is bound to be followed by a closer investigation and application of the Flame Cutting Machine.

F. L. HOFFMAN

ENGINEERING ASPECTS OF OPERATION PLANNING

(Continued from last issue)

The experimental body while in process of construction will reveal many inconsistencies and interferences, which will be shown to the engineering division who will proceed to make corrections or recommend changes. The body when framed will be trimmed. The trimming consists of the cloth and interior hardware. The outside is painted and striped. The body then is thoroughly inspected for appearance and comfort by the engineering division, the board of directors, and the sales-managers.

The chassis draftsmen have in the meantime completed their layouts showing the relation of body to chassis and the various mechanical units. Group layouts are then made, such as motor, transmission, brake, electrical, lubrication, splashers, bonnets, fuel system, cooling system, front and rear axles, exhaust system, and steering. Wood models of some of the units may be required to convey a clear picture of the design of a certain part.

Detail drawings are made from the group layouts. These are studied from the view point of manufacture, tolerances, finishes, and material. At this point the metallurgist is consulted. He determines what kind of material each part is to be made of. It may be necessary for him to produce sample parts and subject them to much severer tests than they will ever be required to withstand during the life of the car.

The detail drawings are checked for interference, limits, practicability of manufacture, finishes and ease of assembly. All drawings ar ethen submitted to the experimental division where a number of chasses will be built and subjected to extremely severe tests over rough roads and hills for periods of time which in hours far exceed the life of any car. Some of the chasses will have the newly designed bodies attached when undergoing the above ordeal.

During these tests more changes are made, which in turn require further testing. All drawings will be revised to agree with results of test, then submitted to the manufacturing division for the planning of operations, the ordering of tools, dies, and miscellaneous equipment to produce the parts. The general consensus of opinion among planning department men is that the engineering division has ten months to do its work, while the planning department has but two. The reason so much time is consumed in the engineering department is obvious from the above paragraphs.

PLANNING OF OPERATIONS

Immediately upon release of blue prints from the engineering department to the planning department, the planning of operations, tooling and equipment is under way.

Blue prints of large parts, or parts which, due to their construction are the first to be considered and in most instances advance information is given the tool designer so he may start the large or intricate tools. These prints are checked for similarity to parts already in use so that they may be run over the same line of equipment as the old part or possibly replace it.

One of the first considerations is the servicing of the old part. The old part may be of such a nature that life time service requirements should be run before changing equipment over for the new part which would be the case of parts having a very small service requirement and expensive equipment. The new part may be so similar to the old that it can be used for service in place of the old without change, or it may differ only slightly by having more or less operations performed upon it, in which case changes will be made in the equipment so they are adaptable to old and new parts. In other cases, new parts will be so different from the old that entirely new tools are required, or if tools on the old part were to be used, they would have to be altered so they would no longer make the old part: then, the old part, if having large service requirement, would be given to the service department to make with the old tools or tooled up inexpensively, if service requirements are small.

Blue prints having been thoroughly checked, new against old, further planning continues when writing operation sheets. Operation sheets must contain sufficient information so they can be used by the following departments: tool designing, estimating, cost accounting, purchasing, production control, stores, manufacturing, service, inspection, time study, and metallurgical.

The method of locating the parts in dies, jigs, and fixtures is now determined and is a very important consideration. This point should be established so that it can be used for all operations which must bear a definite relation to one another. Do not change locating points during the process of machining or you will find troubles developing later which are difficult to locate. One other thing which leads to difficulties, which are almost impossible to check back are found in cases where the original location has been removed by some operation. This is particularly true in large castings such as cylinder blocks, transmission cases, axles, fenders, etc. On small parts which are practically finished all over, the location may be a reamed hole which is established in one of the first operations and will be used until after heat treating, when the hole will doubtless be ground and all the following operations will use this ground hole for location similar to the way the reamed hole was used before hardening.

To plan efficiently, an imaginative mind is of the greatest importance since one must be able to visualize the part located in all the various operations to determine what effect

a particular location will have in the designing of tools or how the accuracy or finish of the part is affected or can the part be held or clamped in fixtures without distortion.

The type of equipment necessary is determined by the number of parts required per unit per day. Parts having a very low production would be manufactured with very inexpensive equipment using standard machines in departments where no line-ups are maintained so that tools can easily be removed to make room for other similar parts. Large parts having a production such that the greater portion of a day is required or small parts having a large requirement will invariably be lined up so that operations will be performed with machines lined up progressively. Operations would be so arranged that automatic machines would be grouped and short operations placed near them so the man would be kept busy. A conveyor or stock tray would be used to carry stock from one machine to the next. In the case of parts such as cylinder blocks, a roller conveyor may be used on which the part rolls from one machine to the next, either directly through the machine (in which case, the machine becomes part of the conveyor) or passes the machine with a short section of conveyor connecting the large conveyor with the machine. Overhead, power-operated conveyors are used where production is large, so that the work is carried from the machining department directly to the assembly line.

(To be continued next issue)

E. R. DeLUIZ

Oldsmobile has been compelled to make two successive increases in its May schedule and the new total will be 39.4 per cent above the April output. Oldsmobile's stock of used cars at the end of April had dropped more than 37 per cent below the used car inventory of a year ago.

An indication of how the rise in the automobile industry has been reflected in the tire industry is the report that the Goodyear Tire and Rubber Company has re-employed 1,700 men since April 1, and the chances are that this number will be raised. Employment so far has been confined to Goodyear employees laid off in 1932 who still remain in Akron.

Chevrolets are going to be sold at retail to the public at the World's Fair Grounds, it was reported recently by those in charge of the General Motors Building at the Century of Progress Exposition. The unique thing about the setup is that a prospective buyer can stand along the Chevrolet assembly line which is now being set up, pick out the particular paint job he wants, and then follow his car through the entire line and drive it away. There will be twenty-five cars a day coming off the line.

Further reflecting the industry's recent gains over 1932, Studebaker recently reported that, as of record May 10, orders for Studebaker and Rockne passenger and commercial cars, both domestic and export, showed an increase of 17.3 per cent over orders as of record May 10, 1932. The total also represents an increase of 17 per cent over orders as of record April 10, 1933.

The curve of motor car sales which has been continuously declining since October, 1929, is being rapidly flattened out under the impulse of renewed public buying, it was indicated this week in the national motor car sales report issued by R. L. Polk & Co. Registration reports from 20 states show that April sales greatly exceeded the totals of preceding months and closely approximated sales in the same month last year. In fact sales in eight of the states exceeded sales for the same month last year, while several other states were close to the 1932 mark.

Hudson Motor Car Company has just announced a new and larger Terraplane Special Six, with a wheelbase of 113 inches, and a base price of $505. This car will displace the former Terraplane Six line, which had a wheelbase of 100 inches, but the Terraplane Standard Six is continued.

Stduebaker's five car racing team, now encamped at the Indianapolis speedway, will benefit greatly by the changes in race rules, according to expert observers. The restrictions on the use of oil, it is expected, will hinder the performance of many of the cars, whereas it will not stop Studebaker, as last year's Studebaker race entries averaged only two gallons per unit. All of this years entries are revamped from the cars which placed third, sixth, thirteenth, fifteenth and sixteenth last year, and all are 85 per cent stock. Four of the cars have been streamlined as a result of comprehensive wind tunnel tests. The fifth is not streamlined, so that Studebaker engineers can get a comparison of the effectiveness of the new design.

LOLA CORBIN S. R. READ

Lloyd V. Harding formerly of the Buhr Machine Tool Co., Ann Arbor, Michigan, is now residing in Wadsworth, Ohio.

We are certainly glad to announce that our Staff Artist, Hans Hansen, received his naturalization papers this past month.

Some of you members, we are sure, do not realize just how important our Journal is getting to be. Recently our faithful member, Mr. Jacob Wohlfeld, stopped into the office and among other things, advised that Sam Taylor of the Kelvinator Corporation was ill in the Good Samaritan Hospital in Dayton, Ohio. As Mr. Taylor was in need of "some

good and interesting reading matter," he suggested that we send him a copy of our latest Journal.

"Bill" Maier has been elected to the Board of Directors, to fill a vacancy occasioned by the resignation of one of the original members of the Board. If Bill's work on the Board of Directors is up to the standard set by his activities as an advertising representative of the Journal, the Board may consider itself very happy in getting such a man.

Our old friend—perhaps we shouldn't refer to him so intimately now that he has become such a big shot—R. C. Reynolds, has been elected President of the Sheffield Machine and Tool Company, 7338 Woodward Ave. Because of a slip made by our otherwise highly efficient editorial staff, this notice failed to appear in last month's Journal.

"Bill" Gray is covering the State of Michigan selling a standard line of V-drive die cast pulleys made by the Congress Tool and Die Company. If anybody can sell 'em, Bill can.

Waste is a loss to the world from which nobody receives a benefit.

PREFACE

THIS is a broad field in which every department of an industrial organization is constantly occupied.

No executive, from the highest to the lowest, in any up-to-date organization is permitted to forget that economy, sometimes even to the detriment of quality, is the watchword.

In the case of large organizations, composed of several units which are in turn engaged on similar work, there is a centralized cost governing department set up which contacts directly with the board of directors, or its equivalent governing body, and is responsible for the cost required to produce the product. This department compares the costs of direct labor in the various plants of the organization and weighs one against the other, bringing pressure to bear on any item which is not comparable to the proper cost. Material, construction, design, manufacturing methods, etc., are all duly considered and many changes which lower costs and still maintain quality are effected.

The tool engineer and time study engineer furnish this department with the bulk of its data. This data, in the case of a new product about to be marketed, is required far in advance of the time when actual production is under way and an actual cost is available. Thus the men who are required to furnish this information know only the approximate selling price and estimated maximum production that will be required by sales.

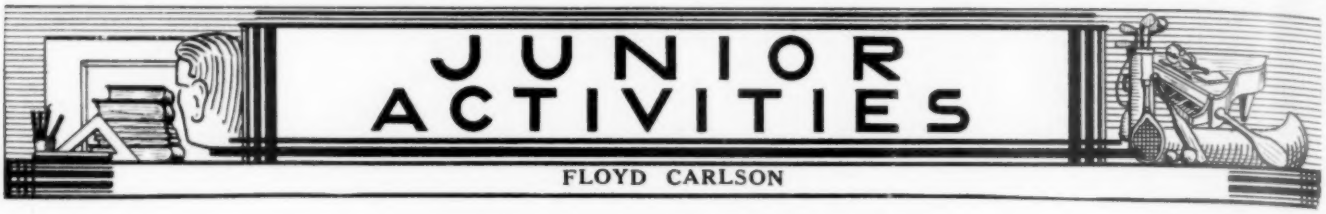
The tool engineer may submit a tool lineup costing far in excess of the expenditures allotted to the program. It is then necessary for him to cudgel his brains for a new, cheaper lineup that will still produce the required production economically.

The time study engineer is confronted with a very similar problem. He must keep his direct labor cost to its minimum on each individual part that is processed through his plant in order to keep the total cost comparable to the cost of another simliar plant which is infinitely better tooled. Methods of processing material, balancing of manpower, material handling are studied and revised to offset excessive direct labor cost.

In many cases it has been shown that a low production schedule may be produced just as economically as a much higher schedule. This is generally effected by the proper selection of methods and equipment by the tool engineer in tooling up the job, followed by an intelligent balancing of operations and man power on the part of the time study engineer who, in a properly organized plant also functions as consultant to both tool and plant layout engineering departments, assisting in the selection of proper equipment and furnishing detailed estimates of labor costs, etc., of proposed processing methods. His is the responsibility of supplying estimated costs of direct labor to be incurred in production of a proposed program and to equal or lower that cost when the program actually is in effect.

The functions of his department are now recognized by every cost-minded chief executive as most necessary to economical plant operation. Budgeting of non-productive materials and supplies and labor are often included in the duties of the time-study engineer. In numerous cases, particularly in plants where group incentive systems are in effect, indirect labor is standardized and satisfactorily operated under the incentive plan of wage payment, thereby rendering this cost constant in direct ratio to production and available for advance estimating.

Further discussion of various subjects of manufacturing economics by some of the recognized authorities in this field will appear in future issues of the Journal. Written criticism will be welcomed—perhaps we can start an argument.



FIRST JUNIOR MEETING

The first meeting of the Junior Activities Section of the A.S.T.E. was held at the Detroit College of Applied Science on Thursday, May, 18th. The evening included an open discussion of what the Juniors would like to do in the future, and the flow of ideas and conversation was lubricated by a case of a certain beverage, for a long time tabooed, but recently declared non-intoxicating by act of legislation.

It was decided that the Junior members would meet the fourth Thursday of every month, and have a speaker on each occasion whose subject would be especially interesting and educational to them.

George Crookston and Melvin Weinberg were selected as Chairmen of the Meetings and Athletic Committees respectively.

It was decided to organize a baseball team to play against the Seniors at the Field Day outing of the Society. Members present at the meeting signed for taking part in the baseball game, but several positions on the team are still open. Therefore, any Juniors who were not present at the meeting, who want to play ball, are requested to get in touch with Mr. Floyd Carlson, by calling Madison 5048 between 10:00 A.M. and 5:00 P.M. or 7:00 and 9:00 P.M.

I LIKE THE DEPRESSION

A Texas Classic

By HENRY ASHLEY

I LIKE the depression. No more prosperity for me. I have had more fun since the depression started than I ever had in my life; I had forgotten how to live, what it meant to have real friends, what it was like to eat common every-day food. Fact is, I was getting just a little high hat.

Three years ago, only one man of the News-Globe organization could be out of town at a time and he had to leave at the last minute and get back as soon as possible. Many times I have driven 100 miles to a banquet, sat through three hours of bunk in order to make a five minute speech, then drive the 100 miles back so as to get ready for work the next morning.

Nowadays, as many News-Globe employees as are invited make those trips and we stay as long as we want to. The whole outfit could leave the office now and it wouldn't make any difference.

I like the depression. I have time to visit my friends, to make new ones. Two years ago when I went to a neighboring town, I always stayed at the hotel. Now I go home with my friends, stay all night and enjoy homecooking. I have even spent the week-end with some of the boys who have been kind enough to invite me.

It's great to drop into a store and feel that you can spend an hour or two or three or a half day just visiting and not feel that you are wasting valuable time. I like the depression.

I am getting acquainted with my neighbors. In the last six months I have become acquainted with folks who have been living next door to me for three years. I am following the Biblical admonition, "Love your neighbors." One of my neighbors has one of the best looking wives I have ever seen. She is a dandy. I am getting acquainted with my neighbors and learning to love them.

Three years ago, I ordered my clothes from a merchant tailor—two and three suits at a time. All my clothes were good ones. I was always dressed up. But now, I haven't bought a suit in two years. I am mighty proud of my Sunday-go-to-meeting clothes. When I dress up, I am dressed up and I don't mean maybe. I like the depression.

Three years ago I was so busy and my wife was so busy that we didn't see much of each other, consequently we sort of lost interest in each other. I never went home to lunch. About twice a week I went home for dinner—at 6:30 o'clock. I never had time to go anywhere with her. If I did go on a party, I could never locate her, since there was always a "blonde" or a "red head" available I didn't much worry about it.

We got stuck up and hifalutin. We even took down the old family bed and bought a set of twin beds—on the installment plan.

When I would come home at night, if my wife was at home, she would already be in her bed and I would crawl into mine. If she came in first, it was vice versa.

We like the depression. We have come down off our pedestal and are really living at my house now. The twin beds are stored in the garage and the old family affair is being used. We are enjoying life. Instead of taking a hot water bottle to bed these cold nights, she sticks her heels in my back just like she did before Hoover was elected.

I haven't been out on a party in 18 months. I have lost my book of telephone numbers. My wife has dropped all the clubs. I believe we are falling in love all over again. I am pretty well satisfied with my wife. Think I will keep her, at least until she is forty and then if I feel like I do now, I may trade her for two twenties.

I am feeling better since the depression. I take more exercise. I walk to town and a lot of folks who used to drive Cadillacs are walking with me. I like the depression.

My digestion is better. I haven't been to see a doctor in a year. I can eat anything I want to.

I am getting real, honest-to-goodness food. Three years ago, we had *fillet mignon* once a week, now we have round steak and flour gravy. Then we had roast beef or guinea hen, now we are glad to get sow-bosom with the buttons on it.

I like the depression. My salary has been cut to where I can't afford to buy lettuce and spinach and parsley and we

can't afford to have sandwiches and frozen desserts and all that damfoolishness, which has killed more good men than the World War.

I like the depression. Three years ago, I never had time to go to church. I played golf all day Sunday and besides I was so darned smart that there wasn't a preacher in West Texas who could tell me anything.

Now I am going to church regularly, never miss a Sunday.

And if this depression keeps on, I will be going to prayer meeting before long.

I like the depression.

NOTE:—We are sorry we did not have an opportunity to print this while the depression was on.—Editor.

HARD LUCK

Binks—That chap pitched three years at Yale.

Winks—What's he doing now?

Binks—President of a bank. His arm went back on him. —Daily Eagle (Brooklyn).

NOT DISPUTED

First Attorney—Your Honor, unfortunately I am opposed by an unmitigated scoundrel!

Second Attorney—My learned friend is such a notorious liar—

Judge (sharply)—The counsel will kindly confine their remarks to such matters as are in dispute.—Globe (Toronto).

THAT'S DIFFERENT

There was great excitement aboard the liner.

"Man overboard!" was the cry.

"Gentleman overboard, if you please," said Mrs. De Snobbe, indignantly. "That's my husband."—Tit-Bits (London).

THEIR SLUMBER TIME

"If I could only get some sleep, I have insomnia, you know."

"Why don't you try counting sheep?"

"Oh, I tried that—and the sheep fell asleep."—Evening Transcript (Boston).

Mother of talented offspring: You ought to hear my Johnny play the piano.

Neighbor lady: Well, how far advanced is he now?

Mother: Oh, he's almost up with Paderewski. He uses both hands already.

Johnny stole a penny,
And to the jail was sent,
The jury said "not guilty,"
So John was in-a-cent.

Panhandler: How about a dime for a cup of coffee, Mister?
Victim: Don't you guys ever drink tea?

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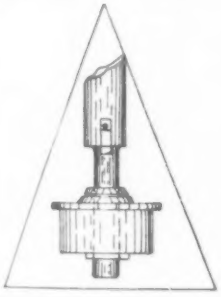

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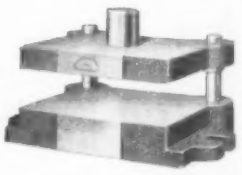

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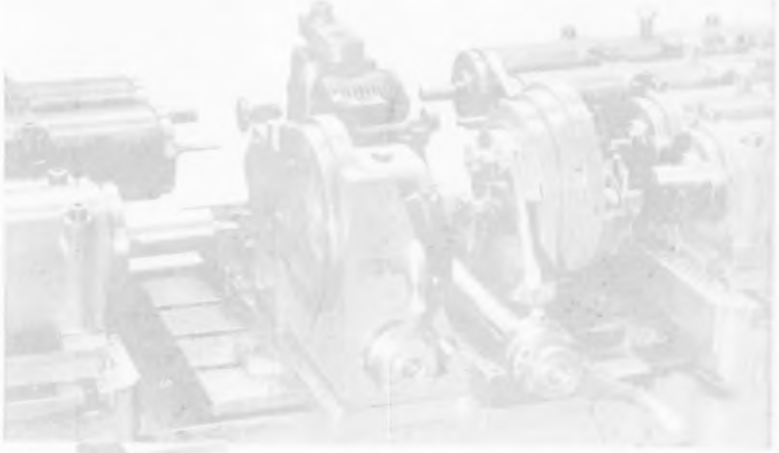
Above single end Bore-Matic is arranged to bore the large and small hole in pump cylinder, bores two holes and faces in one end plate, bores blind hole in other plate and bores pump rotor.

WITH an ever-increasing demand for precision boring, we can furnish just the machine to meet all requirements. For a normal production of but one or a few parts we recommend our simple, fast, single end economical No. 47 Bore-Matic. Where there is a large production, or a number of pieces to be bored, the No. 46 double end multi-spindle machine is ideal.

Fixtures can be furnished either as simple, inexpensive, hand clamped for low production requirements—flexible types with adjustable members suitable for handling a range of similar work—or mechanical, pneumatic or hydraulic operated types suitable for the most exacting of high production requirements. If you have precision boring or facing, regardless of whether the material is non-ferrous, cast iron or steel, let us submit samples and figures for your approval.



The double end Bore-Matic with eight spindles bores both cylinder bore and blind crankshaft hole in housing, piston pin holes, both holes in connecting rod and hole in each end of crankshaft.

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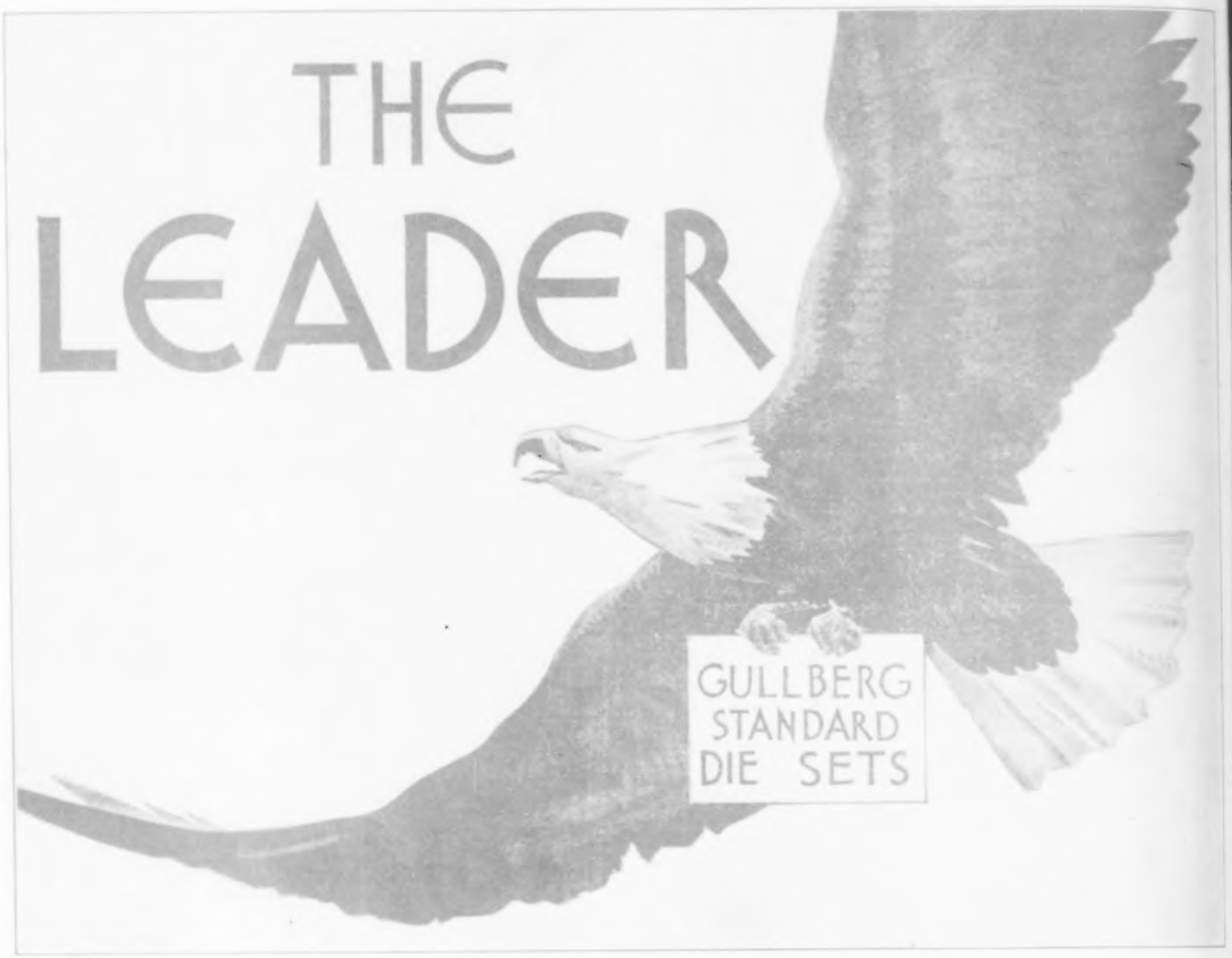

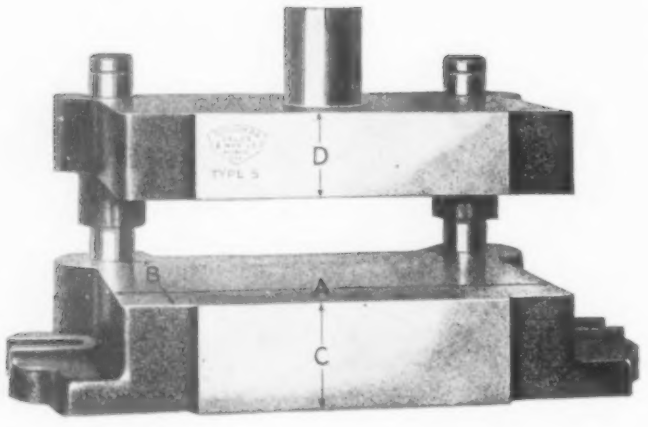

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